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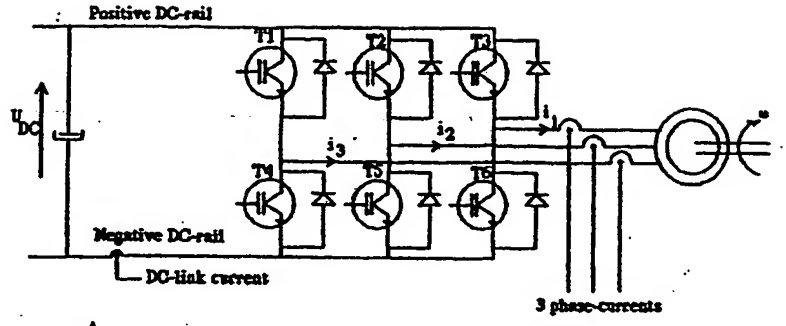
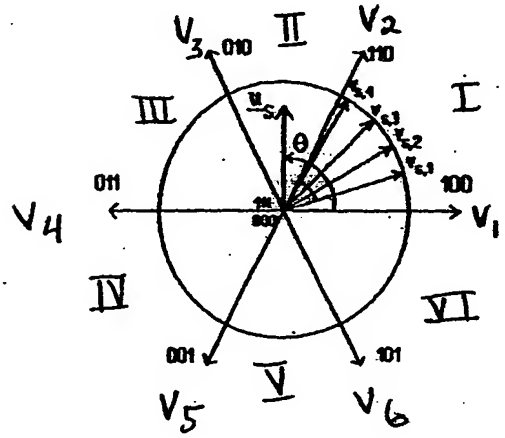


Fig. 1

Fig. 2



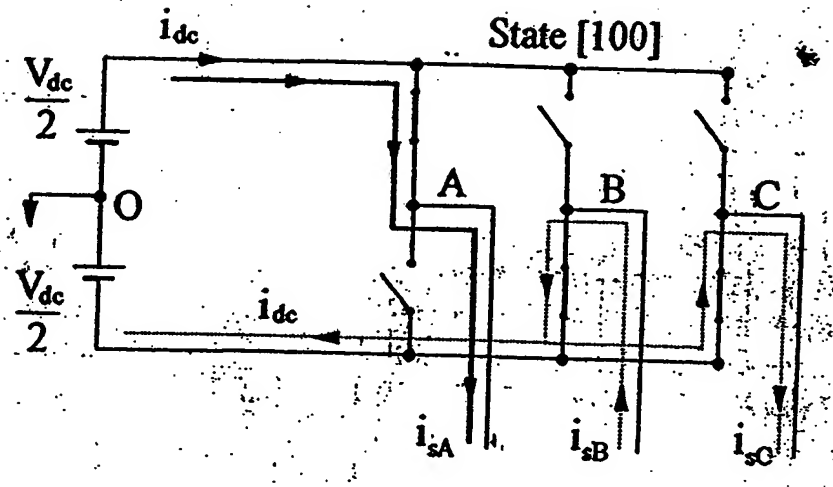
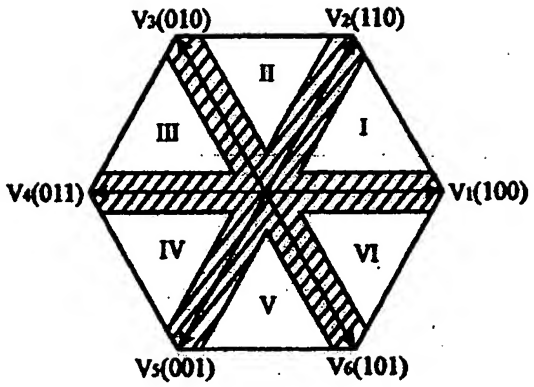


Fig. 3


V3(010)
V2(110)
II
III
I
V4(011)
V1(100)
IV
VI
V
V5(001)
V6(101)

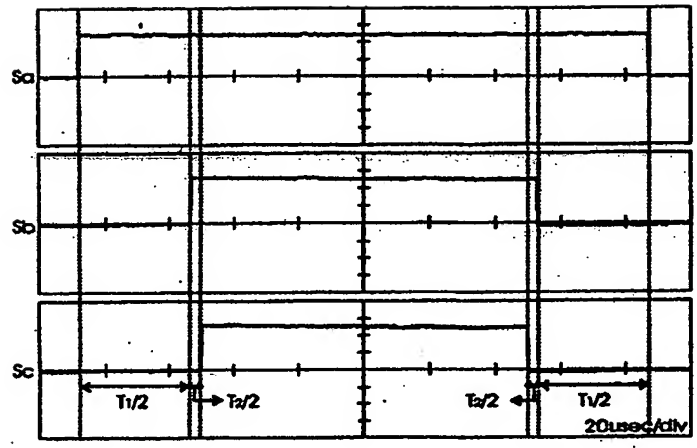
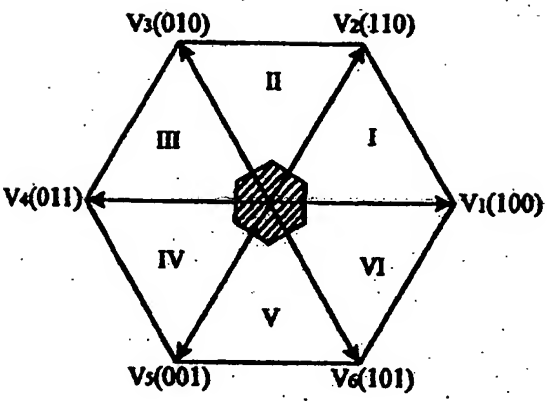

Sa
Sb
Sc
T1/2
T2/2
T2/2
T1/2
20usec/div

Fig. 4


V3(010)
V2(110)
II
III
I
V4(011)
V1(100)
IV
VI
V
V5(001)
V6(101)

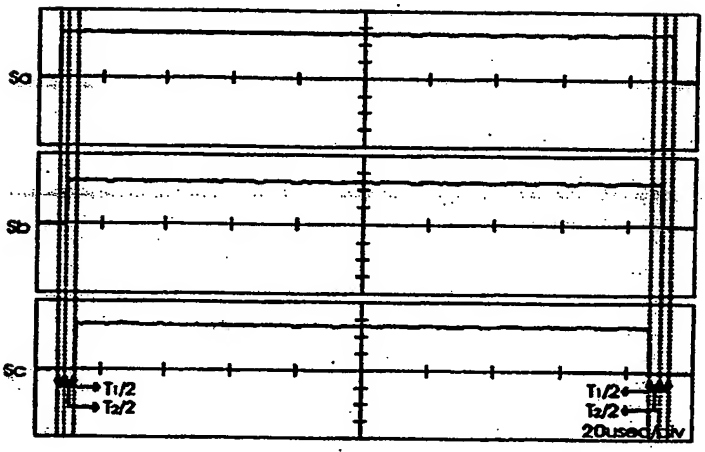
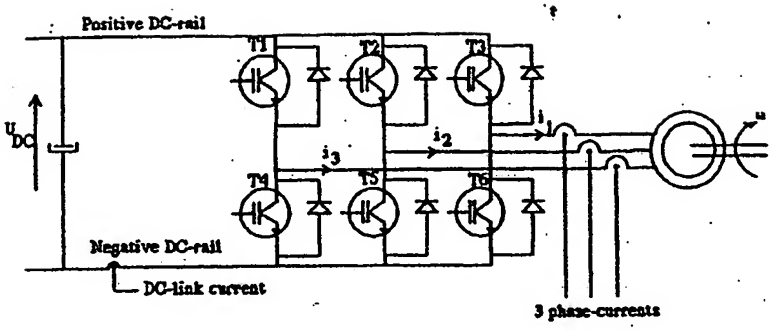

Sa
Sb
Sc
T1/2
T2/2
T1/2
T2/2
20usec/div

Fig. 5



Relationship between voltage vector, DC-link current and actual phase-current.

Voltage Vector	DC-link current i_{DC}
$\underline{u}_1 = (100)$	$+ i_1$
$\underline{u}_2 = (110)$	$- i_3$
$\underline{u}_3 = (010)$	$+ i_2$
$\underline{u}_4 = (011)$	$- i_1$
$\underline{u}_5 = (001)$	$+ i_3$
$\underline{u}_6 = (101)$	$- i_2$
$\underline{u}_7 = (000) = (111)$	0

Fig. 6

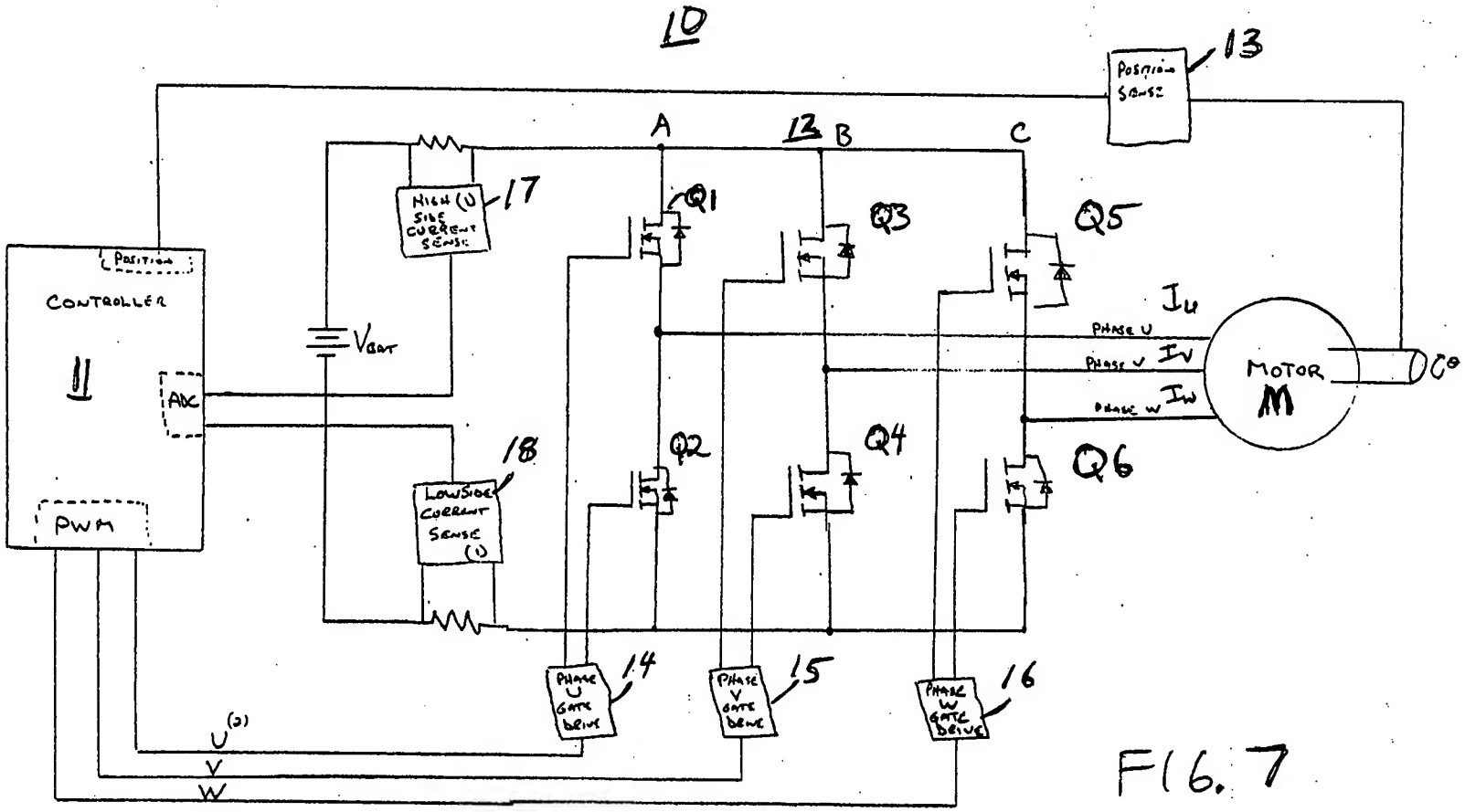

10
13
Position Sensor
A
12
B
C
17
High (U) Side Current Sense
Q1
Q3
Q5
Position
Controller
11
ADC
PWM
V_{BAT}
I_U
Phase U
Phase V
I_V
Phase W
I_W
Motor
M
18
Low Side Current Sense (1)
Q2
Q4
Q6
Phase U Gate Drive
14
Phase V Gate Drive
15
Phase W Gate Drive
16
U(2)
V
W

FIG. 7

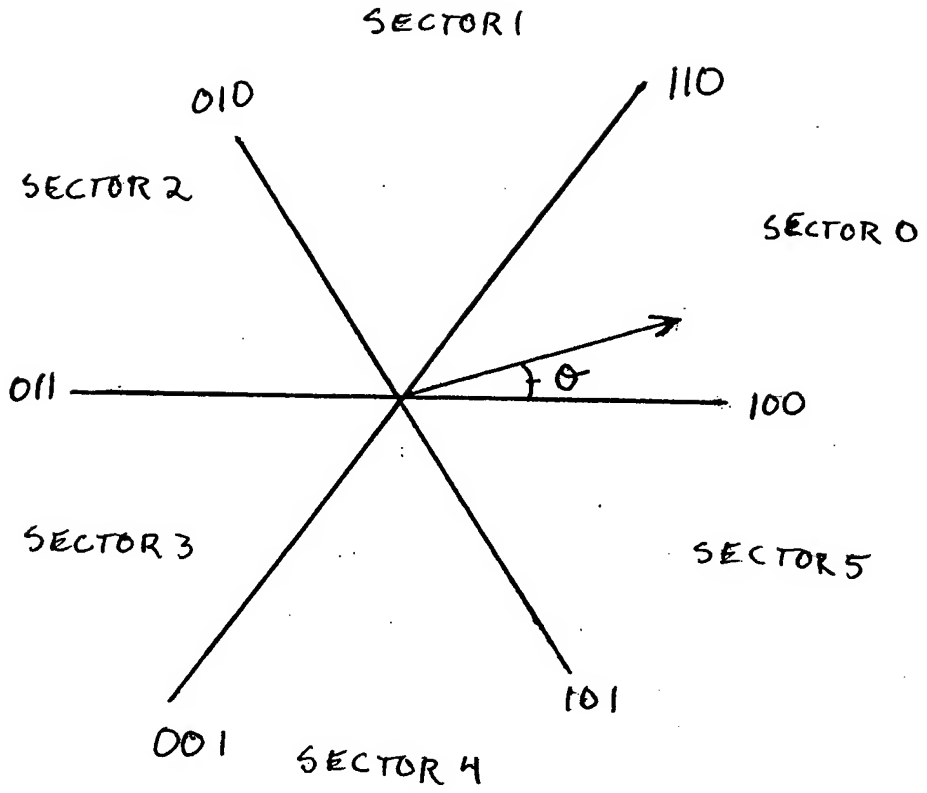

SECTOR 1
010
110
SECTOR 2
SECTOR 0
011
θ
100
SECTOR 3
SECTOR 5
101
001
SECTOR 4

Fig. 8

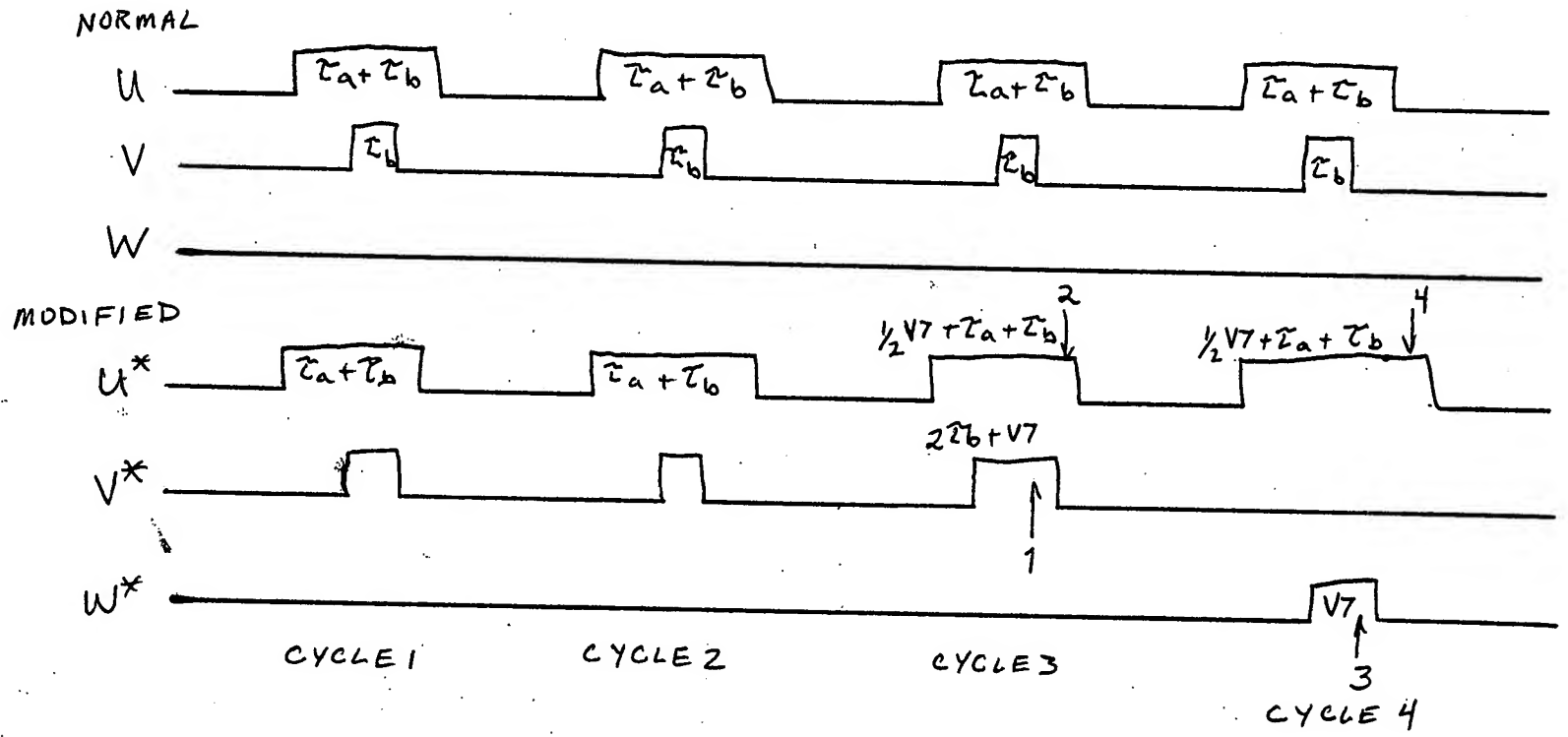

NORMAL
U
V
W
MODIFIED
U*
V*
W*
$\tau_a+\tau_b$
τ_b
$\frac{1}{2}V7+\tau_a+\tau_b$
$2\tau_b+V7$
V7
1
2
3
4
CYCLE 1
CYCLE 2
CYCLE 3
CYCLE 4

Fig. 9

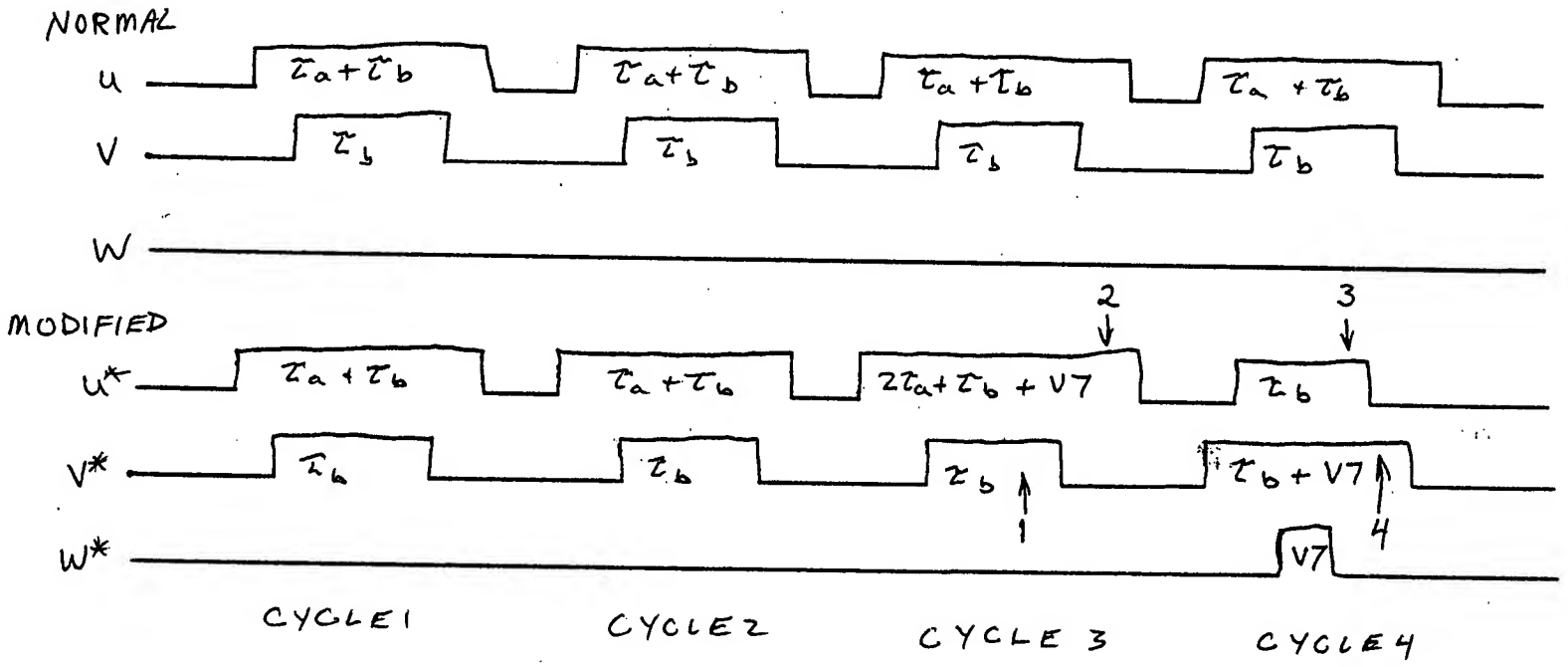

NORMAL
u
V
W
MODIFIED
u*
V*
W*
$\tau_a+\tau_b$
τ_b
$2\tau_a+\tau_b+V7$
τ_b+V7
V7
1
2
3
4
CYCLE1
CYCLE2
CYCLE 3
CYCLE4

Fig. 10

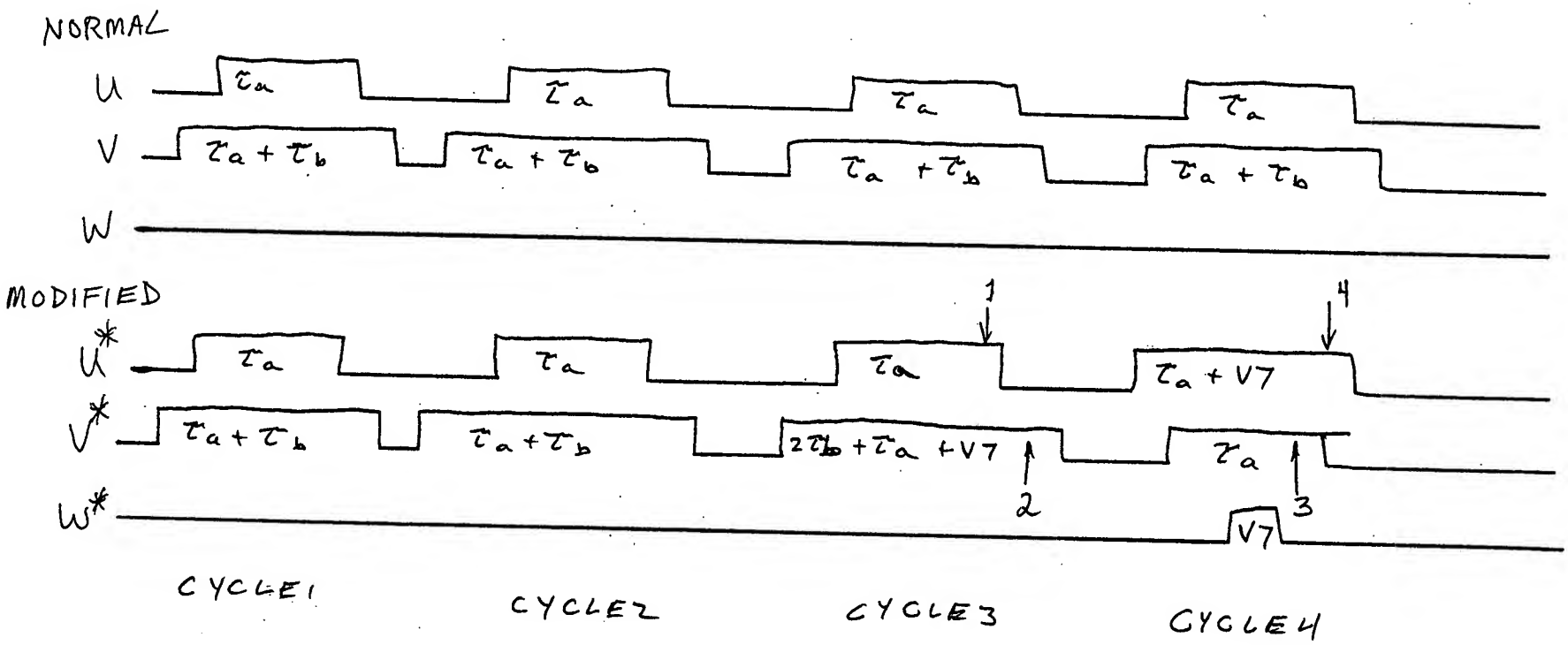

NORMAL
U
V
W
τ_a
$\tau_a + \tau_b$
MODIFIED
U*
V*
W*
1
2
3
4
$\tau_a + V7$
$2\tau_b + \tau_a + V7$
V7
CYCLE1
CYCLE2
CYCLE3
CYCLE4

Fig. 11

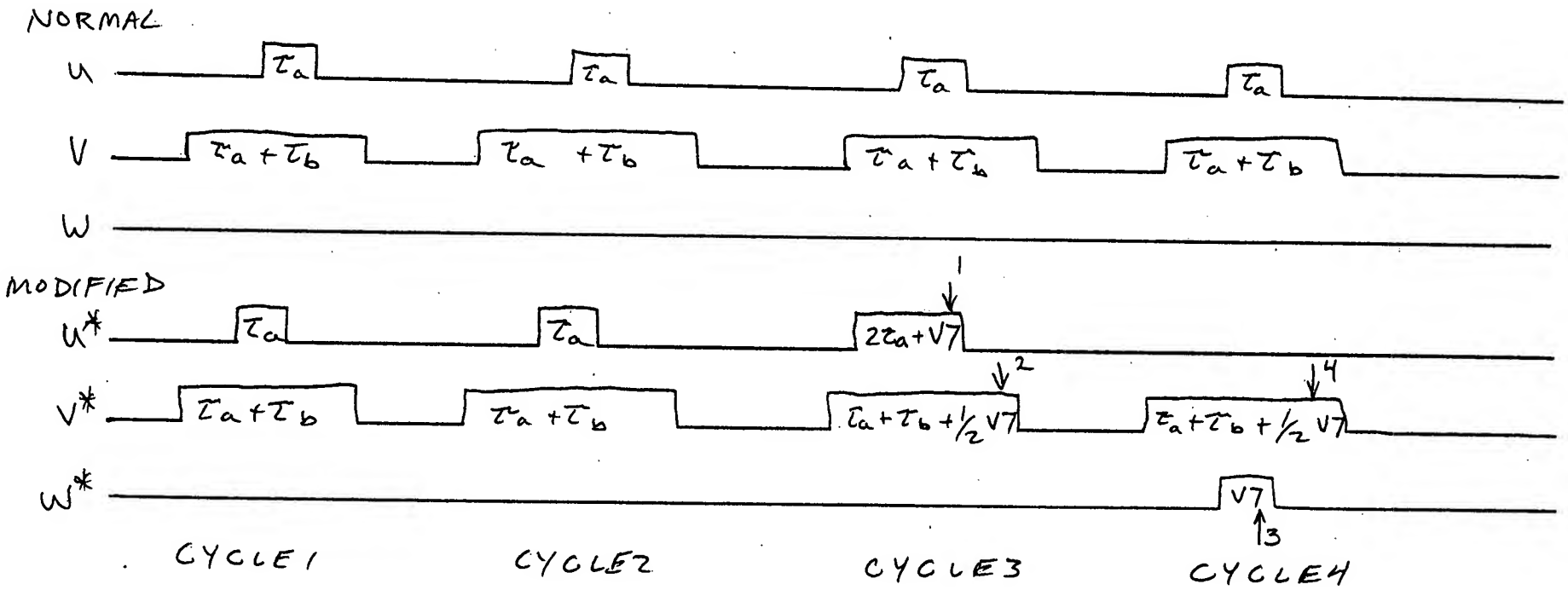

NORMAL
U
V
W
MODIFIED
U*
V*
W*
τ_a
$\tau_a + \tau_b$
$2\tau_a + V7$
$\tau_a + \tau_b + \frac{1}{2} V7$
V7
1
2
3
4
CYCLE1
CYCLE2
CYCLE3
CYCLE4

Fig. 12